MONITORING PLAN

PROJECT NO. T/V-04 COTE BLANCHE HYDROLOGIC RESTORATION

ORIGINAL DATE: July 17, 1995
REVISED DATE: July 23, 1998

Preface

Pursuant to a CWPPRA Task Force decision on April 14, 1998, the original monitoring plan was reviewed for potential reduction in scope. Specifically, there were no reductions in scope, only changes to the format of the document.

Project Description

The Cote Blanche project area is a 31,637 ac (12,655 ha) freshwater marsh located in St. Mary Parish. The project boundaries include the Gulf Intracoastal Waterway to the north, Highway 317 to the east, East Cote Blanche Bay to the south and West Cote Blanche Bay to the west (figure 1).

The Cote Blanche marsh has experienced increased freshwater introduction from the GIWW and westward currents from the Atchafalaya delta (DeLaune et al. 1987). Historical information documents the alterations in marsh types resulting from these hydrologic changes. Marsh type changes have been documented by 1982 USFWS Ecological Atlas Maps and Vegetative Type Maps of the Louisiana Coastal Marshes (Chabreck et al. 1968; Chabreck and Linscombe 1978, 1988). Using aerial photography, planimeter data show the percentages of each marsh type (USDA 1993). In 1949, the area was almost entirely brackish (93%) with a narrow band of saline (7%) associations along the southwestern shoreline. By 1968, the area was divided into intermediate (39%), fresh (13%), and brackish (48%) associations. In 1978, the area was predominantly fresh (63%) and intermediate (37%) associations, where as by 1988 the entire area was identified as fresh marsh.

Construction of the GIWW and numerous oilfield canals have been the predominant causes of hydrologic change for the project area. Major canals such as the Humble and Humble-F canals were dredged between 1937 and 1958 and the British-American Canal and extensions from the Humble Canal were dredged between 1958 and 1974. Major impacts on the area have resulted from increased tidal action and rapid water exchange between the interior marsh and East and West Cote Blanche bays through these oilfield canals and the GIWW. Rapid water exchange and tidal fluctuations have caused breaches in spoil banks of interior canals that have lead to erosion and conversion of broken marsh to open water. Broken marsh began to be detected in the 1952 aerial photography. An area west of the British-American Canal showed some marsh deterioration prior to the dredging of the canal, however, the dredging created more marsh loss in the area. Utilizing historical aerial photography, from 1957 to 1990, the land loss rate for the area has been estimated to average 73 ac/year (29 ha/yr) (Britsch and Kemp 1990).

Water exchange through canal systems have contributed to marsh deterioration in the area resulting in the erosion of organic soils. Sediment-laden water is available from the GIWW but is not being

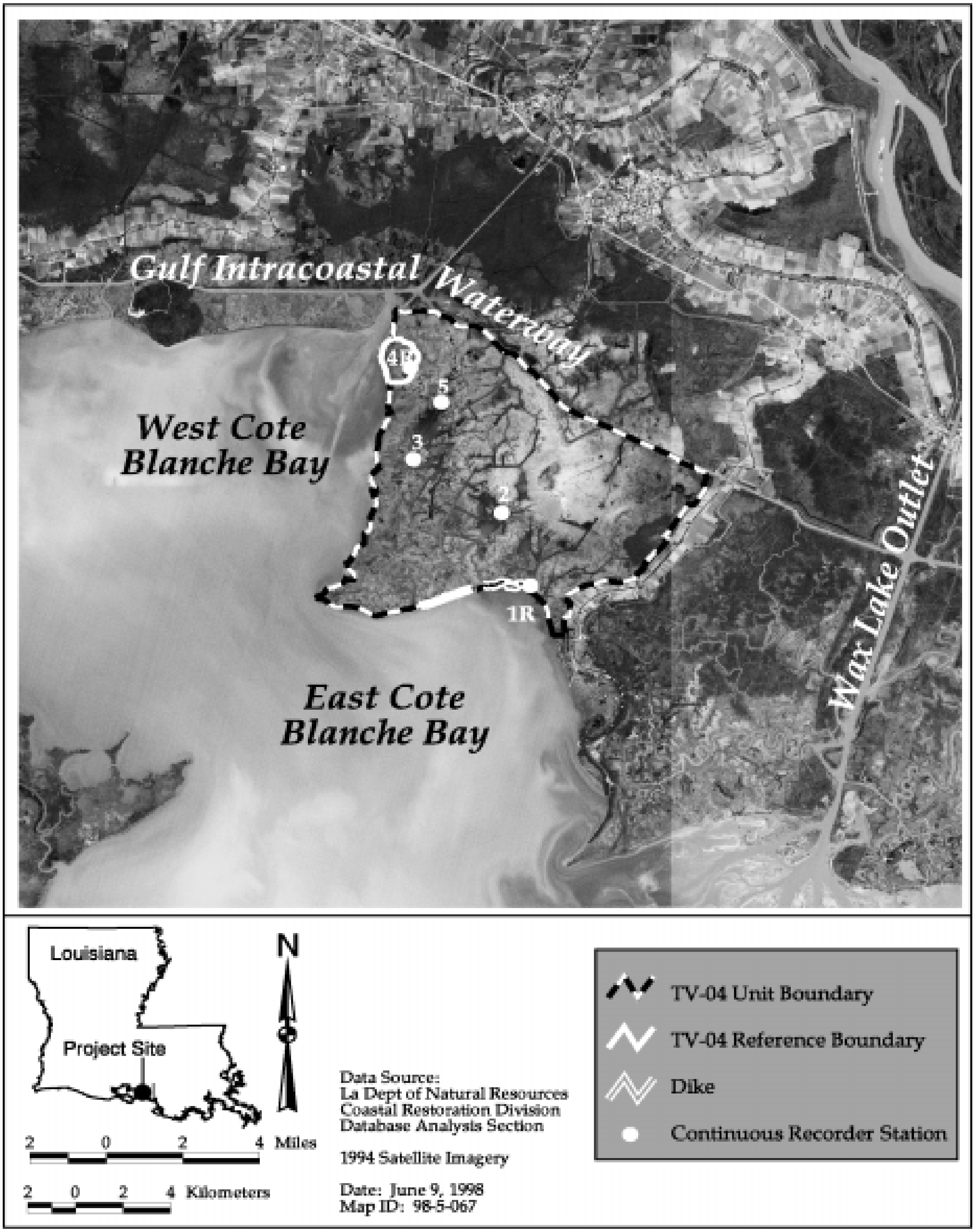

Figure 1. Cote Blanche Hydrologic Restoration (TV-04) project and reference area boundaries and locations of project features.

and *Alternanthera philoxeroides* (alligatorweed). The dominant species in this marsh is *Sagittaria lancifolia* (bulltongue), utilized because of the rapid water exchange characteristic of the area. A total of 6–39 in (0.15 - 1.0 m) of the original soil column has been lost to erosion or other causes (USDA 1993). The estimated subsidence rate for the area is 0.07 in./year (0.18 cm/yr) (USDA 1993). Areas that show the most land loss are adjacent to canals that have highly organic soils and cannot withstand water flow with high velocity (USDA 1969). Common plant species present in the area are *S. lancifolia*, *Eleocharis sp.*(spikerush), *Spartina patens* (marshhay cordgrass), *Hydrocotyle sp.* (pennywort), and *A. philoxeroides* which is well-adapted to increased water levels. However, this and the other species are not able to withstand the extreme tidal energies associated with this system. Once these plants are lost, the organic soil is left unprotected and erosion increases dramatically.

Shoreline erosion on the southern project boundary resulting from wave energy and breaches in adjacent canals was evident from aerial photography as early as 1952. Shoreline erosion rates averaged 10–15 ft/yr (3.0-4.6 m/yr) according to 1952, 1957, 1971, 1979, 1983, and 1990 aerial photography and surveys completed in 1975 by Miller Engineers & Associates. These measurements show an increase in shoreline erosion after 1978 for the Teche/Vermilion basin. Erosion rates averaged 10–12 ft/yr (3.0-3.7 m/yr) from 1941 to 1978 and increased to an average of 20–25 ft/yr (6.1-7.6 m/yr) from 1978 to 1983.

The Cote Blanche Hydrologic Restoration Project contains measures to improve hydrologic conditions in 31,637 ac (12,803 ha) of fresh marsh through low-level weirs placed at major water exchange avenues and through shoreline protection on the southern boundary of the project area.

Project features include:

1. Low-level weir at Mud Bayou
2. Low-level weir at the Humble-F Canal
3. Low-level weir at the intersection of Bayou Long and the Humble Canal system
4. Low-level weir at the intersection of Bayou Carlin and the Humble Canal system
5. Low-level weir at the Humble Canal
6. Low-level weir at Jackson Bayou
7. Low-level weir at the British-American Canal.
8. Shoreline protection (10,000 ft [3 km]) along the southern project boundary.

<u>Project Objectives</u>

1. Reduce water exchange between marshes of Cote Blanche and West and East Cote Blanche Bays to prevent scouring of interior marsh and protect approximately 31,637 ac (12,803 ha) of fresh marsh.

2. Protect shoreline on southern boundary between Humble and British-American canals from wave erosion.

Specific Goals

The following goals will contribute to the evaluation of the above objectives:

1. Decrease variability in water level within the project area.

2. Reduce erosion rate of shoreline along southern project boundary.

3. Decrease rate of marsh loss.

Reference Areas

The importance of using appropriate reference areas cannot be overemphasized. Monitoring on both project and reference areas provides a means to achieve statistically valid comparisons, and is therefore the most effective means of evaluating project success. The evaluation of sites was based on the criteria that both project and reference areas have a similar vegetative community, soil type, and hydrology. The project area is classified as fresh marsh (Chabreck and Linscombe 1988) and contains mainly the highly organic, Kenner muck soils (USDA 1993).

The project area receives a direct influence of fresh, sediment-laden water from westward currents of the Atchafalaya through the GIWW. The northwest corner of the project area was chosen as a reference area for the evaluation of the water levels in a marsh habitat. This area receives the same hydrological influences as the rest of the project area but is located out of the area of influence of the water control structures. Another reference area will be located to the southeast outside of the project area in East Cote Blanche Bay. This area will be used to evaluate the difference between water-levels in East Cote Blanche Bay and the project area. Baseline monitoring will be conducted at all sites and will yield information as to the suitability of both reference areas. A proportional amount of monitoring stations will be located in the reference areas as in the project area.

For the shoreline protection component of the project, the area west of Humble Canal along the southern boundary of the project will be used as a reference area. The reference shoreline has a similar configuration to the shoreline protection component of the project and receives the same hydrological influences from tidal action and wind. A proportional amount of monitoring stations will be located in the reference area as in the project area.

Aerial photography for the habitat mapping monitoring element will be flown for both project and reference areas.

Monitoring Elements

1. Habitat Mapping — To document vegetated and non-vegetated areas, color-infrared aerial photography (1:24,000 scale with ground controls) will be obtained. The photography will be georectified, photointerpreted, mapped, and analyzed with GIS by the National Wetlands Research Center

(NWRC) following procedures outlined in Steyer et al. (1995). The photography will be obtained in 1996 (pre-construction) and in 2002, 2009, and 2015 post-construction.

2. Shoreline Change — To document shoreline movement, continuous differential GPS data will be established at the vegetated marsh edge along the original shoreline behind the proposed breakwater. Using GPS, shoreline position will be documented as-built in 1998, and in 2001, 2004, 2007, 2010, 2013 and 2016 post-construction to provide a template for mapping shoreline changes and movement over time. Shoreline measurements will be taken at the same time of the year. Shoreline positions will be compared to historical data sets available in digitized format for years 1952, 1957, 1971, 1979, 1983, and 1990, and shoreline survey information that is available from Miller Engineers and Associates from 1958–1975. Shoreline erosion rate for the project area will also be compared to the shoreline erosion rate of a reference area located west of the foreshore dike.

3. Water Level — To monitor water levels within and adjacent to the project area, 4 continuous recorders will be placed in project interior open water areas and reference areas to the north and south. Additional continuous recorders may be deployed and/or discrete stations added after adequate data are available to perform a power analysis. Staff gauges will be placed near structures inside and outside of the project area and visited once a month. Both the staff gauges and the continuous recorders will be surveyed to the National Geodetic Vertical Datum (NGVD) to obtain a relationship to marsh level for statistical analysis. Water-level data will also be used to document frequency, magnitude, and duration of marsh inundation. Water level data will be collected every year from 1997-2016.

<u>Anticipated Statistical Analyses and Hypotheses</u>

The following hypotheses correspond with the monitoring elements and will be used to evaluate the accomplishment of the project goals. If the null hypotheses are not rejected, possible negative effects will be examined.

1. Descriptive and summary statistics will be used on both historical data and data collected post project implementation to assess changes in marsh loss rates over time and to assess whether the post project marsh loss rate deviates from the expected "future without project" condition. If a suitable reference is located, descriptive and summary statistics will be used to compare annual marsh loss rates in the project area with that of the reference area.

1,2. Measured rates of shoreline movement (ft/yr) within the project area will be compared between successive years using descriptive and summary statistics. If a suitable reference is located, descriptive and summary statistics will be used to compare annual shoreline movement (ft/yr) in the project area with that of the reference area. Also, historical values for the area as well as data available from other surveys (i.e., USACE, USFWS, LDNR, LSU) will be gathered to document and allow for statistical analysis of long-term shoreline movement along the project area.

3. The primary method of analysis will be to determine differences in mean water level variability as evaluated by an ANOVA that will consider both spatial and temporal variation and interaction. The ANOVA approach may include terms in the model to adjust for station locations, proximity to structures, and seasonal fluctuations. Ancillary data (i.e., precipitation, historical) will be included as covariables when available. This additional information may be evaluated through analysis such as correlation, trend, multiple comparisons, and interval estimation. Descriptive and summary statistics will be used to aid in the determination of differences in water level variability and for calculating frequency and inundation of marsh flooding. Exploratory data analysis will be used to determine an appropriate variable for hypothesis testing (e.g., daily, weekly intervals).

Goal: Decrease variability in water level within the project area.

Hypothesis A:

H_0: Water level variability within the project area will not be significantly less than water level variability within the reference area.

H_a: Water level variability within the project area will be significantly less than water level variability within the reference area.

If we fail to reject the null hypothesis, any possible negative effects will be investigated.

Hypothesis B:

H_0: After project implementation at year **i**, water level variability will not be significantly less than before project implementation.

H_a: After project implementation at year **i,** water level variability will be significantly less than before project implementation.

If we fail to reject the null hypothesis, any possible negative effects will be investigated.

Notes

1.	Implementation	Start Construction: End Construction:	March 1, 1998 September 1, 1998
2.	DNR Project Manager: DNR Monitoring Manager: DNR DAS Assistant:	Herbert Juneau Christine Thibodeaux Mary Horton	(318) 893-1812 (318) 898-2493 (504) 342-4122
3.	NRCS Point of Contact:	Cindy Steyer	(318) 896-8503

4. The twenty year monitoring plan development and implementation budget for this project is $786,937. Progress reports will be available inSeptember1999, 2000, 2002, 2003, 2005, 2006, 2008, 2009, 2011, 2012, 2014 and 2015, and comprehensive reports will be available in September 2001, 2004, 2007, 2010, 2013 and 2018. These reports will describe the status and effectiveness of the project.

5. Types of submerged aquatic vegetation will be determined by dragging the bottom with a rake (Chabreck and Hoffpauir 1962) once a year 25–40 ft from continuous recorder sonde.

6. References:

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Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller and E. Swenson 1995. Quality management plan for Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-file series no. 95–01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

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